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The relationship between multidimensional economic well-being and children's mental health, physical health, and executive function development in South Africa

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Footnote

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Research Highlights

- Explores the relationship between a newly developed multidimensional measure of economic well-being and dimensions of children's development in an economically vulnerable region of South Africa.
- The higher-order model of economic well-being was strongest at predicting developmental outcomes, but there was also support for differential prediction among sub-factors and specific outcomes.
- Material Assets (living environment and other assets) was especially influential demonstrating significant relationships with physical health and executive function development.
- Though useful in comprehensive models, Fiscal Capacity, the traditional measures of economic well-being (employment, income and expenditure), predicted the fewest number of development outcomes.

Abstract

Conceptualizing both economic well-being (EWB) and children's development as multidimensional constructs, the present study examines their association using bioecological developmental theory and structural equation modeling (SEM) with Zulu children (ages 7-10) in KwaZulu-Natal, a highly impoverished region of South Africa (N = 1,958). Relative EWB within impoverished communities consists of three dimensions: material assets (durable goods and living environment), fiscal appraisal (subjective experiences of access to/allocation

of resources), and fiscal capacity (monetary inflow/outflow). Children's development also is measured across multiple dimensions: physical health, mental health, and executive functioning. In addition to an overall association between EWB and children's development across outcomes, the sub-dimensions of EWB are differentially related to aspects of children's development. The dimension of material assets exhibits the greatest association with child outcomes, while fiscal capacity exhibits the least. Implications of these findings are discussed, including the use of multidimensional approaches to measuring EWB to understand, more clearly, its relationship to multiple dimensions of children's development.

Keywords: South Africa, child poverty, bioecological framework, child mental health, child physical health, child executive functioning

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Introduction

Sub-Saharan African studies have found poverty to be associated with psychosocial difficulties, growth stunting and poorer health, speech deficits, and poorer cognitive performance (Barbarin & Richter, 2001). Specific to South Africa, a handful of studies have found a simple composite measure of poverty to be associated with child self-reported internalizing symptoms, including depression (Cluver, Gardner, & Operario, 2009; Cluver & Orkin, 2009), anxiety (Cluver, Gardner, & Operario, 2009; Cluver & Orkin, 2009), post-traumatic stress symptoms (Cluver & Orkin, 2009), and even suicidal ideation (Cluver, Gardner, & Operario, 2009). Studies from the United States have demonstrated that household-level poverty causally affects a child's psychological and behavioral development (as cited in Yoshikawa, Aber, & Beardslee, 2012, p. 274).

Although evidence for an association between poverty and children's health and developmental outcomes exist, the way in which poverty is conceptualized and measured has varied. Furthermore, most studies use single-construct measures of poverty (e.g., food insecurity; Cluver & Orkin, 2009) or simple composites (e.g., sum of four dichotomously coded variables: food security, employment, grant receipt, and access to school; Cluver, Gardner, & Operario, 2009) and, therefore, do not capture the many domains in which poverty is experienced. Recognizing the need to measure poverty as a multidimensional construct, researchers Barbarin and Richter (2001), also in South Africa, used factor analysis to create an empirically-driven measure of socioeconomic status consisting of two factors: material consumption (housing quality, material assets, and expenditures) and social/capital (maternal education, occupation status, food security, and financial assets). Barbarin and Richter then examined the relationship between both the composite measure of socioeconomic status and the two factors separately with children's mental health outcomes.

Given the lack of consistency in the conceptualization and measurement of poverty, and the potential impact on obtained results, there is a need for additional studies that use theoretically sound, empirically-based multidimensional measures of poverty to examine the relationship of poverty with a range of children's developmental outcomes. To address this need, the current study uses the theoretical framework provided in Turbeville, Aber, and Weinberg (2019) and the methodologically rigorous multidimensional measure of economic well-being described in Turbeville, Aber, Weinberg, Richter, and van Heerden (2019). In contrast to most existing approaches to measuring poverty, our multidimensional approach offers a more comprehensive and systematic conceptualization of economic well-being built on the bioecological framework (Bronfenbrenner & Morris, 2006), which considers relevant

cultural and contextual factors and the multiple systems that are very much part of children's development. This approach provides both a thorough conceptualization and a clear strategy to item selection.

Though related to measures of poverty and multiple deprivation, the term "economic well-being" is used to reflect the measure's following features: 1) the focus on *economic* features of deprivation, rather than broader definitions including health, physical safety and social capital, 2) the positive outlook of the items (more assets reflect relatively better economic well-being), 3) the consideration of both subjective and objective measures of economic standing, and 4) the foundation of the bioecological model allowing for conceptualization and measurement across the ecological systems relevant to children's development.

Using this new framework, this study seeks to examine the relationship between economic well-being and a broad range of child development outcomes (mental health, physical health, and executive functioning), departing from earlier studies that have restricted their outcomes to a narrower range (typically mental or behavioral health). This work also contributes to the extant literature by focusing on a large Zulu community sample in the KwaZulu-Natal (KZN) province of southeastern South Africa. During *Apartheid*, Africans were restricted to designated regions of South Africa, termed the "homelands." Over twenty years since the end of *Apartheid*, these former homelands continue to be the most disadvantaged areas of South Africa. The location of this study is in the former homeland of KZN, a predominately Black African region (87% of residents Black/African; Statistics South Africa, 2012). South African children of today are referred to as the "born free" generation and are considered to be living in a time of *de jure* equality; but they continue to cope with the reality of *de facto* inequality left by *Apartheid*. This study marks the first study to use a theory-based multidimensional measure of economic well-being to explore

empirically its relationship to a range of child development outcomes in this vulnerable region of South Africa.

Poverty and Child Development

While literature from resource-rich countries has clearly documented that poverty is associated with a range of adverse child developmental outcomes, much less is known about these relationships in Sub-Saharan Africa and, in particular, South Africa. Additionally, very few South African studies have sought to explore simultaneously the relationship between poverty and multiple child outcomes, thus, leaving an incomplete picture of children in South Africa. Following, we review extant research examining poverty and children's mental and physical health, and executive function development, emphasizing research in South Africa.

Mental health

Approximately 10 to 20% of children and adolescents worldwide suffer from mental health problems (Kieling et al., 2011) and poverty is among the top risk factors (Patel, Flisher, Hetrick, & McGorry, 2007). Western studies have demonstrated that poverty-related indicators are associated with both internalizing and externalizing problems (Duncan, Brooks-Gunn, & Klebanov, 1994; McLeod & Shanahan, 1993; Slopen, Fitzmaurice, Williams, & Gilman, 2010; Yoshikawa, Aber, & Beardslee, 2012). Some South African studies have shown similar trends with poverty associated with higher rates of internalizing symptoms, including depression, anxiety, post-traumatic stress disorder and with social problems (e.g., bullying and peer difficulties) as self-reported by the children and adolescents (Cluver, Gardner, & Operario, 2009; Cluver & Orkin, 2009). However, Barbarin and Richter (2001) found that the composite socioeconomic status measure was not significantly related to adverse mental health in children (internalizing symptoms, aggression, emotional self-

regulation, or oppositionality) as reported by caregivers. Additionally, contrary to expectations, Barbarin and Richter found that material deprivation was related to *better* emotional self-regulation and *fewer* oppositional behaviors and was not significantly associated with internalizing symptoms or aggression.

Notably though, both the Cluver studies and the Barbarin and Richter study were conducted with urban townships of largely impoverished Black African samples. The differences in findings may be due to a number of factors, including sample-specific differences (Cluver's Xhosa-speaking sample of 10 to 19 year old children and adolescents from Cape Town versus Barbarin and Richter's predominantly Zulu, South Sotho, and Tswana-speaking sample of 6 year-old children from the Johannesburg/Soweto area), methodological differences (child self-report in Cluver studies and caregiver-reported in Barbarin and Richter), differences in the time of data collection (the Cluver studies were collected in 2005/2006, over a decade after the end of apartheid and the Barbarin and Richter studies collected data in 1996, approximately two years after the end of *Apartheid*), and/or it also may be due to a difference in how poverty was conceptualized and measured (as a simple composite in the Cluver studies versus an empirically-constructed measure in the Barbarin and Richter). Neither of these South African studies investigated both urban and rural populations, used a theoretically-grounded and empirically-constructed measure, nor did they simultaneously examine reports from multiple raters to provide a diverse picture of childhood mental health in South Africa.

Physical health

Poverty has been shown to be aversely associated with direct measures of child physical growth (e.g., stunting; Abubakar et al., 2008; Barbarin & Richter, 2001; Delpeuch, Traissac, Martin-Prével, Massamba, & Maire, 2000) and with poorer health outcomes in adulthood (Conroy, Sandel, & Zuckerman, 2010). Further, early growth stunting has been associated with shorter adult height, lower levels of education attainment and income earned, and having offspring born at lower birthweights, demonstrating a potential impact on future generations (Richter et al., 2011). For infants and young children, the most common measures include weight-for-age, height-for-age, and weight-for-height (e.g., World Health Organization, 1995) or height-for-age z-scores (e.g., Lundeen et al., 2014); however, there is limited use of these measures with older children. South African studies with adolescents have often used Body Mass Index (BMI; Griffiths, Rousham, Norris, Pettifor, & Cameron, 2008; Kimani-Murage et al., 2011; Pradeilles et al., 2015) and Waist-to-Height Ratio (WHtR; Kimani-Murage et al., 2011; Pradeilles, 2015).

A growing concern in South Africa is the lack of physical activity in children, especially among Black South Africans (Amosun, Reddy, Kambaran, & Omardien, 2007; Draper et al., 2010; McVeigh, Norris, & Wet, 2004; Richter, Norris, Pettifor, Yach, & Cameron, 2007) and those experiencing greater levels of deprivation (McVeigh, Norris, & Wet, 2004) increasing children's risk of bone mass osteogenic effects and later obesity in young adulthood (Richter, Norris, Pettifor, Yach, & Cameron, 2007).

Executive functioning

Given the importance of early executive functioning to children's development of self-regulation (Sarsour, Sheridan, Jutte, Nuru-Jeter, Hinshaw, & Boyce, 2011) and academic skills (Blair & Razza, 2007), there is growing interest in this domain of child development.

Executive functions are typically assessed through direct measures of cognitive inhibition, working memory, and attention shifting (Garon, Bryson, & Smith, 2008; Sarsour et al., 2011). Though no known South African studies have explored the relationship between economic well-being and executive functioning, several studies in Sub-Saharan countries have demonstrated that childhood poverty is associated with poorer executive functioning in children three to six years of age (Fernald, Weber, Galasso, & Ratsifandrihamanana, 2011; McCoy, Zuilkowski, & Fink, 2015). Extending this work Galasso, Weber, and Fernald (2017) followed children from early childhood through middle childhood and found that poverty was significantly associated with poorer cognition and executive functioning (working memory and sustained attention) in early childhood. Further, the wealth gradient widened as the child aged and then stabilize in middle childhood (Galasso, Weber, & Fernald, 2017).

Specific Aims

Despite the high rates of income poverty and multiple deprivations experienced in South Africa by historically disadvantaged groups, there is limited empirical research examining the relationship between relative economic well-being within an impoverished population and a range of children's developmental outcomes. This study aims to fill this gap by using a large, community sample of both peri-urban and rural locations from the KZN region of South Africa, an area that continues to exhibit great disparity and pervasive poverty, to examine the relationship between multidimensional economic well-being and a range of child developmental outcomes (mental health, physical health, and executive functioning) assessed both directly (executive functioning and anthropometric measures) and indirectly (e.g., caregiver and child self-report) to provide a comprehensive picture of the children's development.

This study tests the relationship between relative economic well-being among impoverished households and several domains of children's outcomes as guided by the existing literatures and generates hypotheses to inform future South African studies. We hypothesized better overall economic well-being to be positively related to better child mental health as perceived by children and their caregivers, better child physical health as perceived by children and their caregivers and as directly assessed by anthropometric measures, and stronger child executive functioning as assessed by direct performance measures.

Method

Participants

The present sample is from the first wave of a short-term longitudinal study, "Sibhekelela izingane zethu (SIZE)" or "We look out for our children." The sample consists of 1,961 households, each with a focal child between the ages of 7 years 0 months and 10 years 11 months old at the time of recruitment. For additional information, see Turbeville et al. (2019).

Community context

KZN has approximately 11.07 million residents (Statistics South Africa, 2016): Approximately 95% of the population in KZN is Zulu, who were among the indigenous Black South African groups oppressed in the *Apartheid* system. Except for tribal status, the Msunduzi municipality of KZN is both demographically (household income, type of residents) and geographically (urban/rural) representative of the complexity of South Africa as a whole.

Sampling

Study participants (children and their households) were systematically sampled from 24 communities in the Msunduzi municipality (Turbeville et al., 2019). A comprehensive description of the sampling procedures and methods used for this study can be found in van Heerden (2016). Each of the 24 communities was selected based on the presence of a school serving 7 to 10-year-old children. The communities were purposively selected such that 12 communities are classified as rural and 12 communities as urban or peri-urban. Additionally, 12 communities are classified as having high rates of school matriculation, and 12 are classified as having low rates of matriculation, resulting in 4 sub-groups of six communities each. A target was set to recruit 88 households from each school community. Communities were demarcated using a combination of information about the school's catchment area (provided by school principals), topographical boundaries identified by aerial maps and ethnographic mapping, including transport routes to school and work for adults in the area. The boundary created from these sources of information was then merged with a physical one-kilometer radius in rural and 0.5-kilometer radius in urban school communities (to account for greater population density and overlapping boundaries) to generate a final community boundary centered on the physical location of the school. High-resolution aerial mapping was used to identify and enumerate all households within each community (See Turbeville et al. (2019) for additional information).

Next, all households in each community were enumerated and twenty households were randomly selected to represent cluster nodes (van Heerden, 2016). Following, 29 adjacent households around each cluster node were selected as potentially eligible households. Eligible households (defined as those which served as primary residences for at least one child between the ages of 7 to 10 years and whose members spoke isiZulu) were

recruited to the study. In communities where there were not a sufficient number of eligible households, additional clusters were added. From each of the 1,961 households recruited, a Kish grid was used to randomly select one focal child for the study if there were multiple age-eligible children. The recruitment rate of eligible households was 97%.

At the time of recruitment, the focal child age ranged from 7 years, 0 months to 10 years, 11 months. However, when data was collected, 10 children had turned 11 years. Thus, the sample consisted of 24% seven years old, 27% eight years old, 24% nine years old, 25% ten years old, and .5% eleven years old, with a mean age of 8.5 years old (*SD* = 1.12) and a mean grade of 3.05 (*SD* = 1.30). Fifty-two percent of the children are male (*N* = 1,011; Turbeville et al., 2019).

Data collection procedure

The Research Ethics Committee at the Human Sciences Research Council of South Africa and the Institutional Review Board at NYU approved all study procedures (Turbeville et al., 2019). Following the informed consent process, three face-to-face interviews were conducted in isiZulu (with the household head, the focal child, and the focal child's caregiver) and a direct performance-based assessment of executive function and academic abilities was conducted with the focal child. The household head was selected as the person who viewed themselves as a delegate of the household and they identified all members of the household and responded to a household survey on behalf of each household member. The focal child's caregiver was identified by the household head as the person who supervises the child's daily activities. In approximately 84% of households, the person who completed the caregiver interview was the same person who completed the household head interview; 52% of the caregivers were the children's biological mothers. All survey responses were recorded

electronically on mobile phones. The commercially available Mobenzi Researcher mobile survey software and data management portal were used (www.clyral.com). Respondents were compensated for their time with a food parcel to the value of R30 ($5) at the initial household interview. The child was provided with a small packet of snacks during their interview and psychometric assessment (Turbeville et al., 2019).

Measures

A detailed description of the measures measure development and process of adaptation can be found in Turbeville et al. (2019) and in Online Supplement Summary 1. In the section below, we provide a description of the specific variables used in this study.

Predictor variables

1. Economic well-being. A detailed description of the theoretical grounding is provided in Turbeville, Aber, and Weinberg (2019) and a detailed description of how the economic well-being factor and other sub-factors were derived can be found in Turbeville et al. (2019) and in Online Supplement Summary 2 and Online Supplement Tables 1, 2, and 3 of this paper. This measure of multidimensional economic well-being is built on the bioecological framework (Bronfenbrenner & Morris, 2006) to offer a more comprehensive and systematic conceptualization of economic well-being that considers relevant cultural and contextual factors and also those multiple systems that are very much part of children's development. See Turbeville et al. (2019) and Online Supplement Table 1 for detailed information of the economic well-being variables. Using exploratory and then confirmatory factor analyses in Turbeville et al. (2019), specific items were selected and the dimensionality of economic well-being was explored (See Online Supplement Table 2 for a description of means/percentages for all the continuous and categorical variables of economic well-being). The results of this work supported an integrated, yet differentiated model, with an

overarching higher-order factor of economic well-being and three conceptually distinct subordinate factors: Fiscal Appraisal, Material Assets, and Fiscal Capacity (See Online Supplement Table 3 for the final factor analysis). Fiscal Appraisal represents subjective experiences of access to, and allocation of, resources and is composed of the following eight economic indicators: income comparison to community, financial situation classification, subjective standing, savings, burial insurance, food security, school access, and healthcare access (α = .747). Material Assets represents resources of the household, durable goods and adequate living environment, with added specificity to children and is composed of six economic well-being indicators: material assets, formal dwelling, secure sleeping space for child, piped water, flush toilet, and medical aid (α = .617). Finally, Fiscal Capacity captures the often-used measures of poverty and is composed of three classic economic well-being indicators: employment, income, and expenditures (α = .623). The measurement model of economic well-being had adequate fit (RMSEA = .034; CFI = .914; TLI = .900; see Table 1) and strong interpretability.

Outcome variables

Outcome variables are conceptually divided into, and tested by, four child outcome domains: perceptions of child mental health (caregiver and child reports), perceptions of child physical health (caregiver and child reports), direct measure of child physical health, and direct measure of executive functioning. Below is a summary of each of these outcome domains along with the variables contained in each measure. Reliabilities are reported in the footnotes of Figures 1 and 2.

1. ***Perceptions of child mental health***. 10 child-reported items and 12 caregiver-reported items were selected from the 25-item Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) to measure child and caregiver perceptions of children's mental health. The SDQ has been used in South Africa (e.g., Cluver & Gardner, 2006). Participants responded on a three-point Likert scale ('not true,' 'somewhat true,' or 'certainly true'). For mental health difficulties questions (internalizing and externalizing symptoms), higher scores indicate greater mental health difficulties whereas for mental health strengths questions, higher scores indicate more strengths and prosocial behaviors.

2.

2. Perceptions of child physical health. Four child-reported items and four caregiver-reported items were selected from the 11 items administered to children (five were related to physical quality of life) and five items administered to caregivers from the Peds Quality of Life Inventory (PedsQL™; Varni, Seid, & Rode, 1999) to measure perceptions of children's physical quality of life (QoL). Respondents answered questions using a five-point Likert scale ('It is never a problem' to 'It is almost always a problem'). To improve interpretability, these items were reverse coded so that high numbers equate with better quality of life.

Caregiver's perceptions of children's overall health was measured in the caregiver interview using a five-point Likert scale to the question, "Overall, how is [Focal Child's Name] health? Would you say it is excellent, very good, good, fair or poor?" (Southern Africa Labour and Development Research Unit, 2008). Scores were reverse coded to ease interpretability so that high scores indicate better health. Scores ranged from one to five (M = 3.92; SD = 1.20).

3. Direct measure of physical health. Children's physical health status was directly assessed using anthropometric measurements made during the child interview. These measures included waist circumference in centimeters (M = 58.09, SD = 7.09), weight in kilograms (M = 28.42, SD = 6.67), and height in centimeters (M = 129.30, SD = 8.51). From these measures, Body Mass Index (BMI; weight (kg)/height(m)^2; M = 16.89, SD = 2.49; M = .45, SD = .05) and Waist to Height Ratio (WHtR; waist(cm)/height(cm)) were computed and were used continuously for the analyses in this paper. Notably, though height-for-age is often used as a measure of physical health status (WHO, 1995), this study does not have a reliable measure of children's age in months, which is required for accurately computing height-for-age. As a result, this study focuses on the BMI and WHtR values themselves, not adjusted for age.

4. Executive functioning. Executive functioning was assessed across three domains: working memory, inhibition, and attention shifting. To assess working memory, the ability to manipulate information held in the short-term memory store (Morris & Jones, 1990), a numbers backwards task was administered. Children were read aloud a series of six number sets, each with two trials. Scores on this task reflect the number sets that the child correctly repeated aloud in reverse order. Scores ranged from zero number sets completed to five number sets completed (M = .65; SD = .75).

Inhibition was assessed using the Number Stroop Task in which children viewed stimulus pages depicting various combinations of X's and numbers to measure the child's ability to inhibit an automatic response to provide a correct, but less automatic, response (Gordon, 2016). The Stroop Interference score was calculated based on time in seconds to complete the baseline task (number of X's appearing on the page) subtracted from the time to complete the incongruent task (quantity of numbers displayed when inconsistent with the

number displayed; e.g., 222 is "3" because there are three numbers presented). This score represents the degree of impairment in performance that occurred when the child had to inhibit an automatic response (Gordon, 2016). Thus, lower scores indicate better performance on the inhibition subtest (M = -.25; SD = .27).

Attention shifting was measured using the Dimensional Change Card Sort (DCCS) task which is a measure of cognitive flexibility and represents the ability to switch between operations, tasks, or mental sets (Gordon, 2016; Miyake, Friedman, Emersonm, Witzki, Howerter, & Wager, 2000; Was, 2007). Children matched pictures by 1) color (pre-switch), 2) shape (post-switch), and then 3) with differing rules conditional on whether there was a border presented with the picture (border trial; Gordon, 2016). A DCCS total score was computed ranging from zero to three based on trials passed (M = 1.79; SD = .89).

Covariates

Child age and gender (1 = male, 2 = female) were included in all analyses to adjust for developmental differences in age and gender associated with the outcome variables.

Missing Data

Of the 1,961 households that participated in the study, there were 1,961 household questionnaires completed by the household head, 1,899 caregiver questionnaires, 1,836 child questionnaires, and 1,827 direct assessments of children's cognitive and academic functioning. Of the 1,961 total households, three households were missing large amounts of data due to a failure to collect data relative to the second part of the household survey. As a result, these three households were excluded from this study and the total number of households was 1,958. Within these households, much of the missingness was due to uncollected caregiver questionnaires (N = 91), child questionnaires (N = 126), or child direct

assessments (N = 135). Other notable missingness was the result of built-in skip patterns in the survey, data entry errors, and due to response options of "don't know," "no response," and "refused." As per Allison (2001), the assumption that the data are missing at random is needed for optimal estimation of missing information and is a required assumption to impute missing item values and perform multiple imputation. A variable is said to be missing at random if other variables (but not the variable itself) in the dataset can be used to predict missingness on a given variable. Accordingly, our imputation model predicts missingness from variables we observed in our dataset so that we can expect the imputed values to adjust for predicted differences between the observed and missing values.

The *Mplus* multiple imputation program was used (*Mplus,* Version 7.12, Muthén & Muthén, 1998-2011) to create 20 complete datasets, each based on N = 1,958 households. The analyses for this paper were based on the imputed datasets.

Analysis

Structural Equation modeling (SEM) was used to test the relationship between economic well-being and each domain of children's developmental outcomes. Initial measurement models were derived separately on both economic well-being predictor variables and outcome variables using a series of exploratory factor analyses on the single, complete case (un-imputed) dataset (N = 1,896 caregiver rated outcomes and N = 1,832 child rated outcomes). These models were then tested using a series of confirmatory factor analyses on the 20 imputed datasets (each N = 1,958) to examine separately the underlying latent structure of the set of observed predictor variables and each of the sets of observed outcome variables that comprised the four outcome domains. Four separate structural models were then constructed to test the hypothesized relationships between the higher order economic well-being factor and the underlying latent variables relevant to the four outcome domains

(perceptions of child mental health, perceptions of child physical health, direct measures of child physical health, and executive functioning). These analyses were carried out separately on each of the four children's outcome domains to facilitate the interpretation of the relationship between the economic well-being factor, broadly defined, and the underlying latent variables relevant to each of the four domains. A Bonferroni adjustment was used to correct for multiple comparisons due to the analysis of four separate models, and significance levels are reported using the new critical p-value of .013 (.05/4 tests).

The weighted least squares means and variance adjusted (WLSMV) method of parameter estimation was used due to the presence of both continuous and categorical variables and to account for the clustered nature of the data. Standardized regression coefficients were estimated for all paths of the model. All models controlled for child age and gender and were clustered by community. Several fit indices were examined, including the root mean square error of approximation (RMSEA), the Comparative Fit (CFI) index, and the Tucker–Lewis (TLI) index (Hu & Bentler, 1999). RMSEA values under .06 and CFI and TLI values over .95 are considered to indicate a good fit, and CFI and TLI values over .90 are considered to be an adequate fit. In addition to these fit values, determining the number of factors to extract was based on the factors' collective and individual interpretability.

Results

Structural Equation Modeling: The Measurement Part of the Model

As depicted in Figures 1 through 4, the higher order factor of economic well-being consisted of three underlying factors, Fiscal Appraisal, Material Assets, and Fiscal Capacity. With respect to the outcome variables, three latent constructs represented caregiver perceptions of child mental health and three represented child perceptions of child mental health (Figure 1). One latent construct represented caregiver perceptions of child physical

quality of life and one represented child perceptions of child physical quality of life (Figure 2). All other outcome variables were included in the models as observed variables as their covariance structure was not explained by a set of latent constructs. These observed variables are: Caregiver Reported Overall Health (Figure 2), the physical measures of BMI and WHtR (Figure 3), and the executive functioning measures of Inhibition, Attention Shifting, and Working Memory (Figure 4).

Structural Equation Modeling: The Structural Part of the Model

The hypothesized structural models are displayed in Figures 1 to 4. Results from the analyses of all four models indicated sufficiently high goodness of fit indices (Table 1). As expected, economic well-being had significant direct effects on most of the pathways in the expected directions. Greater economic well-being was significantly associated with fewer caregiver-perceived internalizing symptoms ($\beta = -.181$, $p < .001$), but was not significantly associated with children's self-reports of internalizing symptoms or other domains of mental health (Figure 1). Within the physical health domain, economic well-being was positively associated with caregiver-perceived overall child health ($\beta = .162$, $p < .001$) and physical QoL ($\beta = .139$, $p < .001$; Figure 2). Direct measurement of children's physical health reflected similar findings. Economic well-being was significantly positively associated with higher BMI ($\beta = .181$, $p < .001$) and larger WHtR ($\beta = .138$, $p < .001$; Figure 3). As expected, economic well-being was significantly associated with all domains of executive functioning, including working memory ($\beta = .101$, $p < .001$), attention shifting ($\beta = .104$, $p < .001$), and inhibition ($\beta = -.089$, $p < .01$; Figure 4).

Post hoc exploratory analyses

Given that no known studies have examined the relationship between economic well-being and child development outcomes across both urban/peri-urban and rural samples, we tested the consistency of our results across urban/peri-urban (N = 936) and rural sub-samples (N = 1022). We found consistent results across urban/peri-urban and rural groups for all models, with some aberration in consistency for executive functioning. Consistent with the whole-sample model, in the urban/peri-urban sample, economic well-being was significantly associated with all domains of executive functioning, including working memory (β = .130, p < .01), attention shifting (β = .154, p < .001), and inhibition (β = -.113, p < .01); however, in the rural sample, economic well-being was only significantly associated with working memory β = .067, p < .01). Though not statistically significant, the direction of the relationships between economic well-being and attention shifting (β = .048, p = .104) and inhibition (β = -.042, p = .257) for the rural sub-sample was consistent with the urban/peri-urban sub-sample. (Additional post hoc analyses with the mental health variables, testing for nonlinearity, calculation of the indirect effects of each component of economic well-being, and testing robustness of the model in a subsample of children with no missing data are summarized in Online Supplement Summary 3 and Online Supplement Table 4.)

As described previously, we also examined whether each of the three dimensions (underlying latent constructs) of economic well-being were differentially associated with the individual dimensions of children's development. In particular, we conducted a series of post-hoc analyses to test for the potential differential relationship between the three dimensions of economic well-being and the dimensions of the four domains of child development (16 separate analyses). For these analyses, we used a Bonferroni correction with p = 0.003 (.05/16 tests).

In the first set of analyses, we included the three dimensions of economic well-being in each of four structural models, one per outcome domain (Post hoc group 1). In so doing, we were able to test for the unique contributions of each of the individual dimensions of economic well-being net of the other two dimensions. The fit indices for all four models were comparable to those for the initial hypothesized model as given in Table 1 and fewer associations were found. Greater Material Assets net of Fiscal Appraisals and Fiscal Capacity was significantly associated with larger WHtR (β = .153, p = .002), better attention sifting (β = .212, p = .002), and better working memory (β = .180, p < .001).

Due to the moderate-to-high correlations between the three dimensions of economic well-being (Fiscal Appraisal and Material Assets (r = .793, p < .001), Fiscal Appraisal and Fiscal Capacity (r = .504, p < .001), and Fiscal Capacity and Material Assets (r = .535, p < .001)), the analyses were re-run so that only a single dimension (e.g., Fiscal Appraisal, Material Assets, or Fiscal Capacity) was included in each model, one per outcome domain (Post hoc group 2).

Higher Fiscal Appraisal was significantly associated with fewer caregiver-perceived internalizing symptoms (β = -.153, p < .001), better caregiver-perceived physical QoL (β = .137, p < .001), better caregiver-perceived overall health (β = .166, p < .001), better attention shifting (β = .066, p = .002), higher BMI (β = .135, p < .001), and larger WHtR (β = .094, p < .001).

Higher Material Assets was significantly associated with fewer caregiver-perceived internalizing symptoms (β = -.173, p < .001), better caregiver-perceived physical QoL (β = .159, p < .001), better caregiver-perceived overall health (β = .131, p < .001), better inhibition (β = -.098, p = .001), better attention shifting (β = .137, p < .001), better working memory, (β = .124, p < .001), higher BMI (β = .168, p < .001) and larger WHtR (β = .156, p < .001).

Higher Fiscal Capacity was significantly associated with fewer caregiver-perceived internalizing symptoms (β = -.103, p = .001), larger WHtR (β = .106, p < .001), and higher BMI (β = .136, p < .001).

Discussion

This study examined the relationship between a multidimensional measure of economic well-being and four domains of children's developmental outcomes in a low-income setting in South Africa. Four SEMs were estimated to test the associations between this multidimensional measure of economic well-being and 1) perceptions of children's mental health, 2) perceptions of children's physical health, 3) direct measures of children's physical health, and 4) direct assessments of children's executive functioning. Post hoc analyses examined the relationship between each of the economic well-being sub-factors (Fiscal Appraisal, Material Assets, and Fiscal Capacity) and each of the domains of child developmental outcomes. The relationship between poverty and each of these domains of child development has been documented in separate studies.

Mental Health

As predicted, we found that greater overall economic well-being and higher scores on each of the three sub-factors of economic well-being were significantly associated with fewer caregiver reports of internalizing children's symptoms; however, contrary to predictions, they were not associated with children's self-reports of internalizing symptoms. Further, economic well-being was not associated with children's externalizing symptoms or prosocial behaviors as reported by children or their caregivers. These findings add to the literature from other South African studies. For example, Cluver and colleagues found that poverty was related to children's self-reported internalizing symptoms (Cluver, Gardner, & Operario, 2009; Cluver

& Orkin, 2009) and Barbarin and Richter (2001) found that socioeconomic status was not significantly related to caregiver-reported child behavioral or emotional difficulties. These findings may support the notion that, in this context, children's mental health may not be as influenced by economic well-being as has been observed in Western countries. However, we offer several potential alternative interpretations of these mixed findings.

First, the null findings within the mental health domain may be due in part to the measure not adequately capturing the full range of behavioral challenges experienced by children within this context. While the Strengths and Difficulties Questionnaire (SDQ) has been used in South Africa (Cluver & Gardner, 2006), the current study only included selected items from the SDQ, thus, offering a limited range of mental health symptoms on which to report. Additionally, though the fit indices of the mental health measures were adequate, the reliabilities were rather low, resulting in the potential for missing a relationship between economic well-being and children's mental health. The relatively low internal reliability of the child mental health measures may be due to the limited number of items per factor and/or the limited range of the response options (three-point scale). This study design purposefully included only a subset of items in order to capture children's development across a range of outcomes without untoward respondent burden. Future studies should consider using the complete or fully culturally adapted version of the SDQ or a related measure with higher reliability and cultural validity in South Africa to examine children's mental health across a more complete range of symptoms.

Second, the approach we used for measuring mental health in South Africa (child and caregiver reports in an interview format) may be problematic due to a perception in South Africa that mental health problems are caused by someone who lacks willpower or who experiences a greater number of stress-related factors, rather than with someone who has a medical disorder (Hugo, Boshoff, Traut, Zungu-Dirwayi, & Stein, 2003). Given this

understanding, there is a potential for fear of stigma and under-reporting of mental health symptoms in those who are at greatest risk.

A third factor that could be influencing the differential findings between caregiver- and child- reporting is the potential for an omitted third variable such as caregiver mental health. A wealth of literature in Western countries has documented that the status of caregivers' mental health may adversely impact their own ratings of their children's mental health (Richters, 1992; Youngstrom, Loeber, & Stouthamer-Loeber, 2000). Future studies should examine the extent to which caregiver mental health may influence their own ratings of children's mental health in South Africa. However, Western studies have also found that caregivers tend to rate children's internalizing and externalizing symptoms higher than children self-report their own symptoms (Handwerk, Larzelere, Soper, & Friman, 1999; Kolko & Kazdin, 1993).

Finally, economic well-being was also not significantly associated with child- or caregiver-rated prosocial behaviors (e.g., child shares, is helpful or considerate). This nonsignificant finding should be interpreted in the context of South African culture which includes core values of collectivism, which is expressed through the notion of *Ubuntu.* This represents the value of being at one with one's community and a connection with others (Lesejane, 2006). Thus, in the South African context, the prosocial behaviors that we assessed are aligned with this cultural norm and, thus, may not vary substantially by economic situation.

Physical Health

Regarding perceptions of physical health, economic well-being was significantly associated with caregiver's perceptions of children's physical quality of life (QoL) but was not associated with children's self-reported physical QoL. The lack of consistency in findings across raters is unsurprising given that other studies have also found differences in caregiver and child ratings on QoL measures (Cremeens, Eiser, & Blades, 2006; Upton, Lawford, & Eiser, 2008).

Post hoc analyses of the sub-factors of economic well-being indicate that both Fiscal Appraisal and Material Assets (but not Fiscal Capacity) were significantly associated with caregiver perceptions of both children's overall health functioning and physical QoL. This lends support for the use of multidimensional measures of economic well-being given that traditional measures captured in the Fiscal Capacity subfactor (income, expenditures, and employment) may be inadequate at predicting children's health and physical quality of life.

Importantly, regarding direct measures of physical health, economic well-being was significantly associated with greater BMI and WHtR in the expected directions. Similarly, post hoc analyses were consistent in finding that each of the sub-factors of economic well-being were individually associated with children's BMI and WHtR. This association between economic well-being and physical status is consistent with other South African studies of middle childhood and adolescence (Griffiths et al., 2008; Kimani-Murage et al., 2011). Given pervasive food insecurity, poorer nutritional quality, limited sanitation and clean water, and poor health resources that many children in KZN experience, those living in relatively greater poverty may be at greater risk for physical health-related problems.

Executive Functioning

Consistent with prior studies in the United States and in Sub-Saharan Africa, economic well-being was significantly associated with all three components of executive functioning (e.g., Fernald, Weber, Galasso, & Ratsifandrihamanana, 2011; Galasso, Weber, & Fernald, 2017; McCoy, Zuilkowski, & Fink, 2015; Raver, Blair, & Willoughby, 2013; Sarsour et al., 2011). Post hoc analyses to examine the consistency of the findings across peri-urban/urban and rural subgroups found that in the urban/peri-urban sample economic well-being was significantly associated with all domains of executive functioning; however, in the rural sample, economic well-being was only significantly associated with working memory and, though not significant, the direction of the relationship for attention shifting and inhibition was consistent with the peri-urban/urban subgroup. Because children's rule-switching flexibility (e.g., attention shifting) might be more influenced by varying cultural experience than other domains of executive functioning (Legare, Dale, Kim, & Deák, 2018), cultural differences between peri-urban/urban and rural communities might offer some explanation for the different patterns of association across subgroups (e.g., difference in play materials and education). Given that this is the first study to examine executive functioning in both rural and peri-urban/urban South African communities, additional research is needed to understand potential differences between groups and why, in the rural setting, the relationship between economic well-being and attention shifting and inhibition, although in the expected direction, was not statistically significant.

Additional post hoc analyses found that the three sub-factors of economic well-being were differentially related to the three domains of executive functioning. Material Assets was significantly associated with all three domains of executive functioning. Fiscal Appraisal was only significantly associated with better attention shifting (not inhibition or working

memory). However, Fiscal Capacity was not significantly associated with any executive functioning outcomes.

These findings offer a first examination of the executive functioning of South African children. Given that Western studies have demonstrated a relationship between executive functions and children's reading and mathematical development (e.g., Blair & Razza, 2007), these findings may be especially important to explore further in South Africa. Additionally, by focusing on middle childhood, our study extends the existing literature in Sub-Saharan Africa, which has generally been limited to children three to six years of age (e.g., Fernald, Weber, Galasso, & Ratsifandrihamanana, 2011; McCoy, Zuilkowski, & Fink, 2015) with the exception of Galasso, Weber, and Fernald (2017) who followed children through middle childhood. It is well documented that children in KZN are underperforming somewhat on measures of reading and mathematics ability with approximately 44% of KZN sixth grade students considered non-numerate (compared to 40% of South African children) and 28% considered non-readers (compared to 27% of South African children; Department of Basic Education, 2010). Future studies should examine the relationships among economic well-being, executive functioning and children's academic development.

Patterns of Association

While the higher-order factor of economic well-being was strongest at predicting a range of child developmental outcomes than were the three individual sub-factors, there was also clear support for differential prediction among sub-factors. Interestingly, the traditional measures of economic well-being (Fiscal Capacity, composed of employment, income and expenditure), predicted the fewest number of child outcomes. This finding adds to an emerging consensus that, while these traditional measures are useful for comprehensive models of economic well-being, they are insufficient when used alone, and perhaps especially

so in low-income countries. This is a caution for empirical studies that solely rely on these classically used measures of poverty for predicting children's developmental outcomes. Both Fiscal Appraisal and Material Assets were associated with a range of outcomes across all domains. Material Assets (formal dwelling, piped water, medical, and other assets) was especially influential, demonstrating significant relationships with WHtR, working memory and attention shifting even when controlling for the other highly correlated sub-factors of economic well-being. Though these relationships need to be evaluated further, our findings indicate that there may be unique associations between Material Assets (controlling for Fiscal Appraisal and Fiscal Capacity) and children's development, especially children's physical and executive function development.

Implications, Limitations and Future Directions

This study seeks to fill several gaps in the existing South African literature examining economic well-being and children's development. For one, this study offers a first attempt at exploring the relationship between a newly developed multi-dimensional measure of economic well-being (Turbeville et al., 2019) and a wide range of children's developmental outcomes in KZN, an economically vulnerable region of South Africa, with a predominantly African population. Black South Africans continue to suffer the lasting effects of *Apartheid* and remain the most disadvantaged group with 65% of Black South African children living below the poverty line compared to only 4% White South African children (De Lannoy, Leibbrandt, & Frame, 2015). Given this disparity there is a great need for more research in this region, especially among the Black South African population.

The results of this study are potentially relevant to policymakers, practitioners, and community leaders in South Africa. Our findings further demonstrate the need for interventions focused on improving the poorest children's relative economic well-being.

Consistent with the bioecological model, we found that disadvantaged children's development, especially physical and cognitive domains, was influenced most by more tangible factors of economic well-being directly affecting children's daily experiences, as captured by the Material Assets sub-factor (formal dwelling, piped water, medical, and other assets). This is in contrast to less tangible measures of economic well-being that indirectly affect children's daily experiences, such as those captured by the Fiscal Capacity sub-factor (employment, income, and expenditures), which was associated with the fewest outcomes. Thus, there is great potential value for policymakers to develop interventions that extend beyond improving Fiscal Capacity to address poverty and inequality, but also to ensure that, at the household level, such improvements are translated into decisions that improve the material conditions of children's daily experiences (particularly living conditions and material assets).

While our within-group analyses of a representative sample of impoverished households in KZN offers considerable strengths, it is also an important limitation to acknowledge. A potential explanation for some of the null findings in this study may be attributed to the limited range in economic well-being within our sample. Restriction in the range of a variable is known to attenuate the relationship of that variable with others (Weinberg & Abramowitz, 2016). Thus, even with a multidimensional measure, we may not have sampled households broadly enough on economic well-being to see differential relationships with some of children's developmental outcomes. Future studies should further investigate this relationship using our measure of economic well-being in a sample with a broader range in economic well-being.

Importantly, given the cross-sectional nature of this study, we cannot make any causal claims or test the relationships between economic well-being and child development over time. A truly causal analysis of the influence of household economic well-being on children's

development would require research designs that permit such causal inference. As one example, Western literature has well-documented the effects of both current and persistent poverty (e.g., Duncan, Yeung, Brooks-Gunn, Smith, 1998; Mcleod & Shanahan, 1993; Slopen, Fitzmaurice, Williams, & Gilman, 2010). Thus, future studies should explore if similar effects exist in South Africa. A longitudinal design, not unlike the study conducted by Hair, Hanson, Wolfe & Pollak (2015), could be conducted in South Africa to enable researchers to examine the relationship between economic well-being and children's development over time.

Additionally, the results obtained in this study are limited to the ages of the children in this sample. A sample containing different aged children could produce different results due to potential differences in children's development. Accordingly, it is recommended that future studies be conducted on the relationship between economic well-being and children's developmental outcomes using a sample of children whose ages are different from those in this study.

Finally, around the world, studies of the influence of poverty on children's development have typically explored only one or two domains of children's functioning (e.g., only mental health measures), thus failing to provide a more comprehensive picture of children's development. This study begins to fill this gap by moving beyond single outcome measures to assess multiple domains of children's development (multi-trait) using multiple modes of assessment (multi-method). Our findings indicate that different aspects of economic well-being may be differentially associated with different domains of children's development, even within an impoverished region. Future studies should seek to replicate these findings and, if found to be consistent, explore potential mediating mechanisms by which economic well-being affects children's development. Additionally, because this study is a first attempt at examining the multidimensional model of economic well-being proposed

in Turbeville, Aber, and Weinberg (2019) and Turbeville et al. (2019), the analyses were conducted separately by domain to deconstruct the complex models proposed. Future studies should consider building on this work to develop and test integrated, comprehensive models that aim to capture both economic well-being and children's developmental outcomes holistically. Such advances in developmental science will facilitate the design and evaluation of program and policy interventions for children and youth in low- and middle-income countries globally (Wuermli, Tubbs, Petersen, & Aber, 2015).

Data availability statement: The data that support the findings of this study are openly available in the Human Sciences Research Council data repository (Human Sciences Research Council, 2016a, 2016b, 2016c) at http://curation.hsrc.ac.za/Datasets-SPADAA.phtml.

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Table 1

Fit Indices of the Measurement and Structural Models

Model	RMSEA	CFI	TLI
Measurement models			
Economic well-being	0.034	0.914	0.900
Caregiver reported mental health	0.039	0.955	0.942
Caregiver reported physical QoL	0.053	0.998	0.995
Child self-reported mental health	0.044	0.941	0.923
Child self-reported physical QoL	0.027	0.994	0.988
Structural models (Hypothesized models)			
Perceptions of mental health	0.012	0.939	0.933
Perceptions of physical health	0.017	0.964	0.959
Direct measure of physical health	0.024	0.942	0.934
Executive functioning	0.023	0.930	0.918
Structural models (Post hoc group 1)			
Perceptions of mental health	0.012	0.936	0.928
Perceptions of physical health	0.017	0.963	0.958
Direct measure of physical health	0.023	0.945	0.935
Executive functioning	0.024	0.925	0.911
Structural models (Post hoc group 2)			
Perceptions of mental health			
Fiscal appraisal	0.014	0.942	0.933
Material assets	0.015	0.937	0.927
Fiscal capacity	0.017	0.942	0.931
Perceptions of physical health			
Fiscal appraisal	0.014	0.988	0.985
Material assets	0.015	0.989	0.987
Fiscal capacity	0.013	0.996	0.994
Direct measure of physical health			
Fiscal appraisal	0.022	0.979	0.973
Material assets	0.028	0.970	0.957
Fiscal capacity	0.022	0.995	0.990
Executive functioning			
Fiscal appraisal	0.021	0.967	0.956
Material assets	0.025	0.940	0.911
Fiscal capacity	0.030	0.972	0.936

Figures

Figure 1. Structural equation model of the relationship between economic well-being and perceptions of children's mental health. Solid arrows indicate statistically significant relationships with Bonferroni correction $p < .0125$. Dashed arrows indicate non-significant relationships. Child reported prosocial $\alpha = .48$; child reported externalizing $\alpha = .47$; child reported internalizing $\alpha = .62$; caregiver reported prosocial $\alpha = .59$; caregiver reported externalizing $\alpha = .64$; caregiver reported internalizing $\alpha = .50$.

Figure 2. Structural equation model of the relationship between economic well-being and perceptions of children's physical health. Solid arrows indicate statistically significant relationships with Bonferroni correction $p < .0125$. Dashed arrows indicate non-significant relationships. Child reported physical QoL $\alpha = .54$. Caregiver reported physical QoL $\alpha = .77$.

Figure 3. Structural equation model of the relationship between economic well-being and direct measures of children's physical health. Solid arrows indicate statistically significant relationships with Bonferroni correction $p < .0125$. Dashed arrows indicate non-significant relationships.

Figure 4. Structural equation model of the relationship between economic well-being and children's executive functioning. Solid arrows indicate statistically significant relationships with Bonferroni correction $p < .0125$. Dashed arrows indicate non-significant relationships.

Supporting Information Legend

Supplementary Summary 1: This summary details the measure development process.

Supplementary Summary 2: This summary further details the economic well-being theory and measure construction and development.

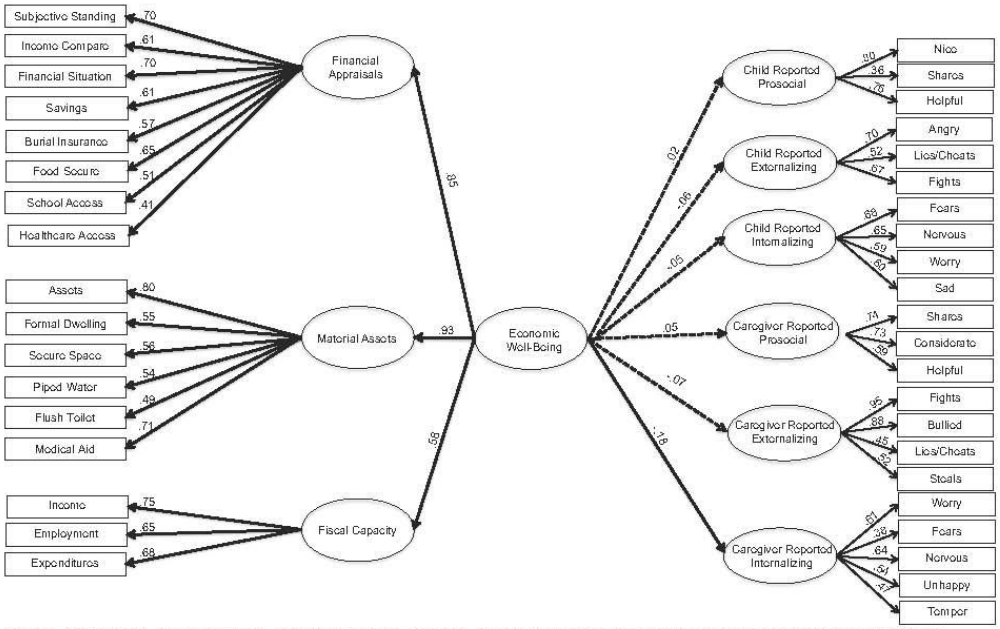
Supplementary Summary 3: This summary details additional posthoc analyses testing for potential nonlinearity in the relationship between economic well-being and each of the developmental outcomes and posthoc analyses further examining the mental health outcomes.

Supplementary Table 1: Supplementary Table 1 provides a summary of the economic well-being items.

Supplementary Table 2: Supplementary Table 2 provides descriptives for each of the Economic Well-Being variables.

Supplementary Table 3: Supplementary Table 3 provides the results of the confirmatory factor analysis of Economic Well-Being, including reliabilities for each of the sub-factors.

Supplementary Table 4: Supplementary Table 2 provides the indirect effects of each component of economic well-being



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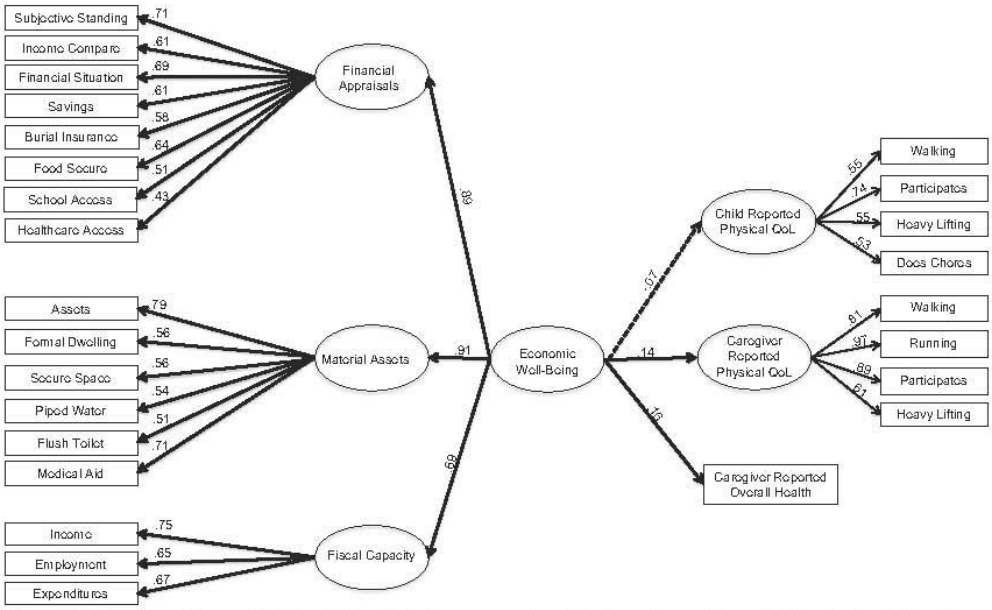

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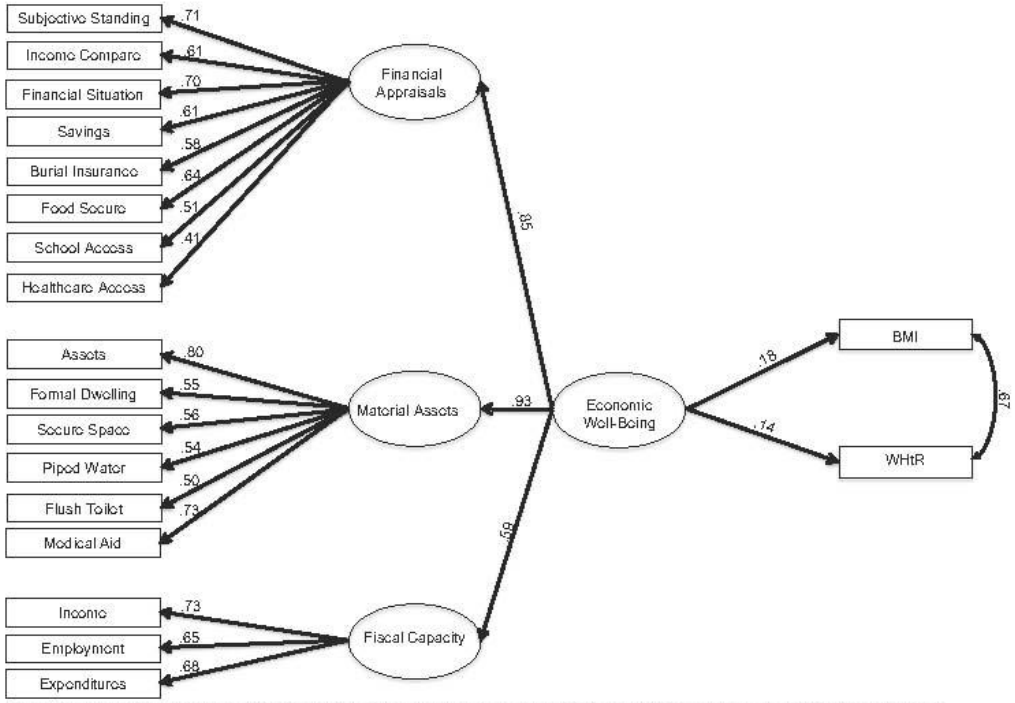

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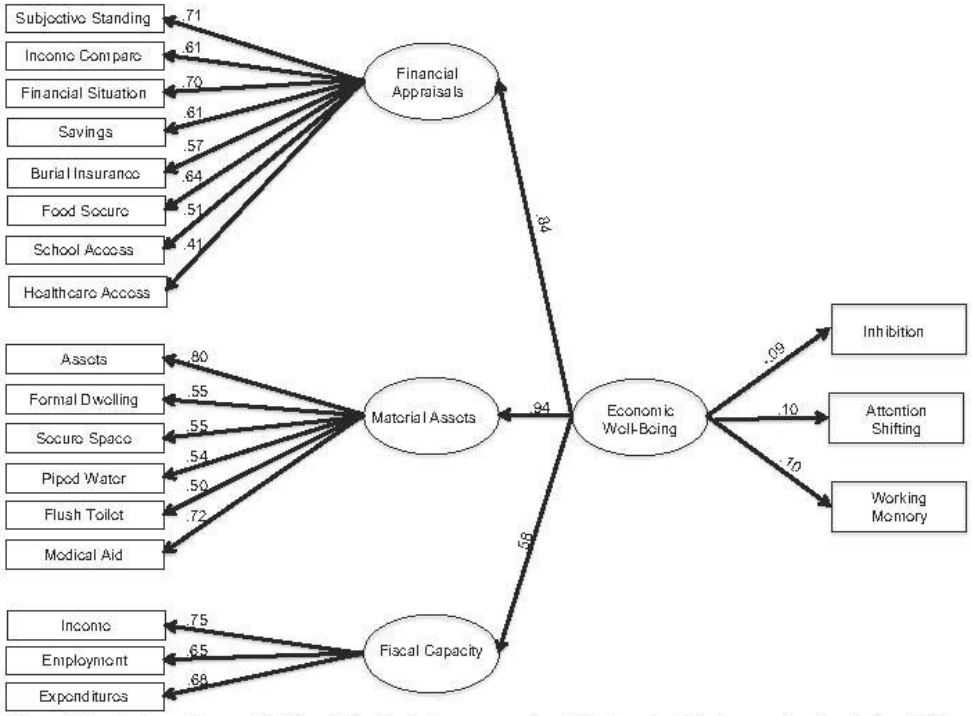

Figure 4. Structural equation model of the relationship between economic well-being and children's executive functioning. Solid arrows indicate statistically significant relationships with Bonferroni correction $p < .0125$. Dashed arrows indicate non-significant relationships.